the next aggregation and distribution node point for further distribution and routing.

[27] These aggregation and distribution nodes will smoothly partition the distribution of bandwidth into the deeper access distribution layers until the customer is receiving single or multiple wavelengths that carry their specific data. Ideally the last link to the customer will carry data at a level consistent with direct optical-to-electrical conversion into a customer's premise equipment or network terminating device (NTD) where the wasteful and lossy optical-to-electrical conversion is no longer an issue. From the network perspective, the customer return path data will appear to be packets mixed with many other packets located within a specific wavelength channel directed to that metropolitan fiber hub. From the metropolitan primary aggregation/distribution node, the packets will be directed to next lower layer distribution nodes, aggregated into new packets that are multiplexed and directed via a suitable (possibly different) wavelength to the next lower or deeper distribution layer node. Ultimately, this process is repeated until the customer receives a locally generated wavelength with their specific packets.

[28] IP-based broadband communications are ideally suited to the FSO communications environment and service applications because the customers data "packets" are sequentially labeled (header) such that if a packet is lost to the network and not received by the customer, the network is alerted and able to resend the packet. This architecture works well in unstable transmission and "bursty" mediums such as the atmosphere and is suitable for data intensive applications such as high-speed interactive /multimedia Internet. IP architectures are troublesome for applications such as traditional POTS (Plain Old Telephone Service), voice and video which rely on continuous and smooth sequential data flow from the network to the customer to provide the perceived high quality service. Tremendous research and development resources are being successfully applied to IP architectures to improve their voice and video compatibility; such service enhancements should be directly compatible with transport technologies such as FSOC and as such complementary to the above embodiment.

[29] From the customer's perspective, the outgoing traffic will be a single modulated wavelength (possibly already packetized) directed to the nearest lowest layer network aggregation node via fiber, free space or radio. At this node location the customer's low bandwidth data will, if necessary, be optically-to-electrically converted, packetized and assigned a new optical wavelength suitable for being multiplexed and aggregated with other customer packets heading into increasingly higher bandwidth streams back to the core network. The aggregation and distribution nodes will have to be capable of wavelength demultiplexing the multiple incoming and outgoing wavelengths, reading optically transported packet header information from up-stream/down-stream locations and changing the wavelength-assigned packets to more suitable wavelengths for re-multiplexing the packets back into the outgoing packet stream. Wavelength conversion prior to re-multiplexing, may also be a necessary feature for the above described system to avoid wavelength clashes and crashes (two identical wavelengths arriving at the same point at the same time from different sources) within the mesh domain and conformance to outgoing (up-stream) wavelengths. This may be particularly important for locally generated wavelengths.

[30] At the highest levels of this local access network, the customer's packets may be routed over multiple network-provided wavelengths from the network hub. The primary node may locally select new wavelengths that are directed down-stream, and transmitted via consecutive nodes to the customer's final last node drop. At the last drop, a dedicated wavelength will provide connectivity to that single customer or multiple customers in the case of a multi-tenant unit (MTU) or apartment, or, similarly, a small multi-business commercial structure. Choices of multiple or single wavelengths that can be demultiplexed and reassigned at each aggregation and distribution nodes will be a feature of this local access network. Depending on local customer traffic, the multiple wavelength-based packets that are not redirected to local customers are multiplexed back, unchanged, into their specific wavelength or reassigned to a new locally available wavelength up-stream/down-stream and cross-connect channels. Two methods of wavelength packet distribution are possible; wavelength-specific packet distribution and

wavelength non-specific packet distribution. It is also possible to have an adaptive blend of both wavelength distribution architectures where specific customers are prepared to own and pay for a specific delivered wavelength while the rest of the customers are supported by a packet and wavelength mix determined by the local distribution nodes.

[31] In wavelength-specific packet distribution, a dedicated customer wavelength (provided by the network) is delivered to/from each distribution node carrying all the customer's traffic to that location. This fixed wavelength assignment reduces the system flexibility and redundancy. If there are multiple local customers assigned to that wavelength and distribution node location, specific customer packet routing and distribution will occur at the node by a variety of distribution means including, for example FSOC, fiber and millimeter wave radio frequency. This single wavelength distribution architecture is compatible with star/branch architectures requiring packet and wavelength allocation by the network central office. Customer packet allocation with this scenario is fixed by the bandwidth available for each wavelength and the number of customers. The star/branch architecture is simple and low cost but has minimal flexibility and compatibility for mesh type link redundancy.

[32] In wavelength non-specific packet distribution, a customer packet can be assigned to any wavelength that is being routed through the specific node; the packet header is read and if recognized, demultiplexed to the local distribution layer and on to the customer. If the packet header is not recognized, the packet is passed on and multiplexed with the outgoing packet traffic on a suitable wavelength and transmitted on to the next distribution node for regeneration and distribution. In this configuration a particular wavelength may travel the full length of the multi-hop branches until it reaches its customer. The wavelength non-specific packet distribution architecture is capable of off- loading (dropping) and on-loading (adding) different customer packets at each node and providing multiple branch route to and from the network.